CLAIMS

1. A common rail fuel pump (8) for supplying fuel to a common rail fuel volume of an internal combustion engine, the fuel pump (8) including:

a pumping plunger (10) that is reciprocable within a plunger bore (14) provided in a pump housing (16) under the influence of a cam drive arrangement (18, 20) to cause fuel pressurisation within a pump chamber (12), wherein the drive arrangement includes a cam driven drive member (20) coupled to the plunger (10) to impart drive thereto, in use, so that the plunger (10) performs a pumping cycle including a pumping stroke and a return stroke,

an inlet metering valve (46) operable to permit control of the quantity of fuel supplied to the pump chamber (12) during the return stroke of the plunger (10), and

an outlet valve (58) for controlling the supply of pressurised fuel from the pump chamber (12), through an outlet passage (30) to the common rail fuel volume in circumstances in which the inlet metering valve (46) is closed,

wherein the outlet passage (30) communicates with a pump outlet (38) which is substantially co-axially aligned with the inlet metering valve (46) and the plunger (10).

2. The common rail fuel pump (8) as claimed in claim 1, wherein the inlet metering valve includes an elongate inlet valve member (46) that is co-axially aligned with the plunger (10).

3. The common rail fuel pump (8) as claimed in claim 1 or claim 2, wherein the inlet metering valve (46) is housed within a valve housing (32), the valve housing (32) being arranged so that respective drillings provided in the valve housing (32) and the pump housing (16) align to define, at least in part, the outlet passage (30).

4. The common rail fuel pump (8) as claimed in any one of claims 1 to 3, wherein the outlet valve of the pump assembly (8) is a hydraulically operable non-return valve (58) located within the outlet passage (30).

5. The common rail fuel pump (8) as claimed in any one of claims 1 to 4, the inlet metering valve (46) being further operable to allow opening thereof during the return stroke to permit filling of the pump chamber (12) and to allow closure thereof following an initial period of the pumping stroke, thereby to permit a quantity of fuel within the pump chamber (12) to be dispelled through the inlet metering valve (46) to low pressure during the initial period.

6. The common rail fuel pump (8) as claimed in any one of claims 1 to 5, wherein the inlet metering valve (46) is further operable to allow opening thereof prior to a final period of the pumping stroke so as to minimise Hertz stresses on a cam of the cam drive arrangement (18, 20).

7. The common rail fuel pump (8) as claimed in any one of claims 1 to 6, wherein the plunger bore (14) is provided with filling port (64) and wherein the plunger (10) is co-operable with the filling port so that when the plunger (10) covers the filling port (64) fuel is unable to flow into the pump chamber (12) through the filling port (64) and when the plunger (10) uncovers the filling port (64) fuel is able to flow into the pump chamber (12) through the filling port (64).

8. The common rail fuel pump (8) as claimed in claim 7, wherein the filling port (64) is defined at one end of a filling passage (62) provided in the pump housing (16), wherein said filling passage (62) communicates with a low pressure fuel reservoir.

9. The common rail fuel pump as claimed in any one of claims 1 to 8, wherein the inlet metering valve (46) is a two-position, single seat valve.

10. A common rail fuel supply system for use in an internal combustion engine, the system including a common rail fuel volume for supplying fuel to a plurality of fuel injectors of the engine and at least one common rail fuel pump (8) as claimed in any one of claims 1 to 9, wherein the or each common rail fuel pump (8) is arranged to supply fuel through a respective pump outlet (38) to the common rail fuel volume.

11. The common rail fuel supply system as claimed in claim 10, including a plurality of common rail fuel pumps.

12. A control method for a common rail fuel pump (8) as claimed in any one of claims 1 to 9 including:

holding the inlet metering valve (46) open during the return stroke to permit fuel to be supplied to the pump chamber (12) from a low pressure source,

closing the inlet valve (46) to permit pressurisation of fuel within the pump chamber (12) during the subsequent pumping stroke, and

opening the inlet metering valve (46) prior to a final period of the pumping stroke so as to terminate pressurisation of fuel within the pump chamber (12) and to ensure Hertz stresses on a cam of the cam drive arrangement (18, 20) are minimised.

13. The control method as claimed in claim 12, including closing the inlet metering valve (46) after an initial period of the pumping stroke so as to dispel a proportion of fuel that is supplied to the pump chamber (12) during the return stroke back to low pressure, thereby to control the quantity of fuel which is pressurised within the pump chamber (12) during the pumping cycle.